BANK OF CANADA
BANQUE DU CANADA

Discussion Paper/Document d'analyse
2015-8

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Bank of Canada Discussion Paper 2015-8

October 2015

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by

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ISSN 1914-0568

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Acknowledgements

We are indebted to Bob Amano, Agathe Côté, José Dorich, Jeremy Harrison, Sharon Kozicki and Stephen Murchison for helpful comments and suggestions. Monica Mow provided excellent research assistance. Finally, we are grateful to Alison Arnot and Glen Keenleyside for editing the draft. All remaining errors and omissions are our responsibility.

Abstract

Bank of Canada research done prior to the most recent renewal of the inflation-control agreement in 2011 concluded that the benefits associated with a target below 2 per cent were insufficient to justify the increased risk of being constrained by the zero lower bound (ZLB) on nominal interest rates. International experience and analysis since the 2011 renewal has reinforced the importance of the ZLB. Despite the deployment of unconventional monetary policy measures by many central banks, the ZLB has proven to be a more severe and persistent obstacle to the achievement of policy goals than expected. At the same time, analysis by the Bank and others has found that interest rates are likely to be lower on average in the future than they were during the first two decades of inflation targeting. As a consequence, the probability of being constrained by the ZLB is likely higher. Together, these factors suggest that a target above 2 per cent should be considered. This paper provides an overview of the current state of knowledge and key outstanding issues regarding the costs and benefits of a higher inflation target.

JEL classification: E, E5, E52, E58
Bank classification: Monetary policy framework; Inflation targets; Inflation: costs and benefits

Résumé

D'après les recherches effectuées à la Banque du Canada avant le dernier renouvellement de l'entente sur la maîtrise de l'inflation en 2011, les avantages découlant d'une cible inférieure à 2 % ne justifiaient pas le risque accru d'être contraints par la borne limitant à zéro les taux d'intérêt nominaux (la « borne du zéro »). L'expérience acquise et les analyses menées à l'échelle internationale depuis le renouvellement de 2011 ont confirmé l'importance de la borne du zéro. Bon nombre de banques centrales ont mis en place des mesures de politique monétaire non traditionnelles, mais la borne du zéro s'est révélée un obstacle à la réalisation des objectifs de politique monétaire plus grave et plus persistant que prévu. En outre, selon les analyses conduites à la Banque et ailleurs, les taux d'intérêt devraient à l'avenir être inférieurs en moyenne au niveau qu'ils affichaient pendant les vingt premières années du ciblage de l'inflation. Par conséquent, la probabilité d'être contraints par la borne du zéro est sans doute plus élevée qu'anticipé. Compte tenu de tous ces facteurs, une cible supérieure à 2 % devrait être considérée. Les auteurs présentent une vue d'ensemble de l'état actuel des connaissances ainsi que les principales questions en suspens entourant les avantages et les inconvénients d'une cible d'inflation supérieure.

Classification JEL : E, E5, E52, E58
Classification de la Banque : Cadre de la politique monétaire; Cibles d'inflation; Inflation : coûts et avantages

1. Introduction

Most advanced-economy central banks currently target inflation of 2 per cent or thereabouts (Lavigne, Mendes and Sarker 2012). However, in recent years, many observers have suggested that consideration should be given to inflation targets above 2 per cent (see, e.g., Williams 2009; Blanchard, Dell'Ariccia and Mauro 2010; Ball 2014; Krugman 2014). They argue that the costs of the 2007–09 global financial crisis and its aftermath were greatly amplified because conventional monetary policy was constrained by the zero lower bound (ZLB) on nominal interest rates.[1] In their view, higher inflation targets would mitigate this constraint, allowing central banks to provide greater stimulus when needed.

Canada's inflation-targeting regime was established by an agreement between the Government of Canada and the Bank of Canada in 1991. With this inflation-control agreement, which has been renewed every few years since 1991, Canada became the second country in the world to adopt an inflation-targeting regime.[2] Since 1995, the agreement has set the level of the inflation target at 2 per cent—the midpoint of a 1 to 3 per cent control range—and has given the Bank effective independence for achieving it. This framework has led to low, stable and predictable inflation while encouraging more stable economic growth.

Prior to the most recent renewal of the inflation-control agreement in 2011, the Bank initiated an ambitious research effort to determine whether an inflation target lower than 2 per cent would generate significant net benefits for the economy. This research concluded that the benefits associated with a target below 2 per cent, while greater than previously estimated, were insufficient to justify the risk of being more frequently constrained by the ZLB (Bank of Canada 2011).

International experience and analysis since the 2011 renewal has reinforced the importance of the ZLB. Despite the deployment of unconventional monetary policy measures by many central banks, the ZLB has proven to be a more severe and persistent obstacle to the achievement of policy goals than expected. At the same time, analysis by the Bank and others has found that interest rates are likely to be lower on average in the future than they were during the first two decades of inflation targeting. As a consequence, the probability of being constrained by the

[1] In most of the literature and experiences that we review in this paper, the effective lower bound on nominal interest rates is treated as zero or slightly positive. For this reason, we use the term "zero lower bound" or ZLB. Recently, however, a number of central banks have introduced negative policy interest rates. It will be important to monitor and review the experiences of these central banks with negative nominal interest rates.

[2] New Zealand began to target inflation in 1990.

ZLB is likely to be higher in the future than in the 1990s and early 2000s.[3] Together, these factors suggest that consideration should be given to a target above 2 per cent. Against this backdrop, the Bank is undertaking a careful analysis of the costs and benefits of adjusting the target. However, as Côté (2014) emphasizes, the 2 per cent inflation target has served Canada well, so the bar for change is high.

In this paper, we provide an overview of the current state of knowledge and key outstanding issues regarding the costs and benefits of a higher inflation target as a complement to earlier Bank analysis that studied the effects of a lower inflation target. Sections 2 and 3 summarize the benefits and costs of higher inflation, respectively. Section 4 discusses outstanding issues and proposes avenues for future research. Section 5 offers some conclusions.

2. Potential Benefits of a Higher Inflation Target

The principal anticipated benefit associated with a higher inflation target would be a reduction in the frequency and severity of ZLB episodes. However, before turning to the ZLB, we briefly discuss a secondary benefit that may arise due to downward nominal wage rigidity.

Downward nominal wage rigidity

A higher inflation target may alleviate the macroeconomic effects of downward nominal wage rigidity (DNWR). Firms and workers may be reluctant to cut nominal wages for a variety of reasons, including money illusion, historical convention, perceptions of fairness and signalling effects (see, for example, Amirault, Fenton and Lafleche 2013; Bewley 1999). DNWR can have adverse macroeconomic effects in situations that require a decline in real wages to facilitate labour market adjustment. Positive inflation mitigates the effects of DNWR by eroding real wages even if nominal wages do not fall. The higher the inflation target, the less likely it is that DNWR will prevent the decline in real wages that is needed to facilitate economic adjustment over a given time horizon. While there is some evidence of downward nominal wage rigidities in Canada, Crawford and Wright (2001) conclude that their effects do not appear to be economically significant. Others, however, continue to argue that this could be an important issue. For example, Fortin (2013) presents more recent evidence for Canada, suggesting that a 2 per cent inflation target could lead to significant costs in the form of higher unemployment (raising it by 1 to 2.7 percentage points). Daly and Hobijn (2014) argue that the effects of DNWR "likely have played a role in shaping the dynamics of unemployment and wage growth during the last three [U.S.] recessions and subsequent recoveries." In light of the ongoing debate and the availability of new data, the importance of DNWR should be re-examined.

[3] However, financial regulatory reform and the use of macroprudential policies may reduce the likelihood of crises and thereby reduce the probability of ZLB episodes. These effects are difficult to quantify and require further research.

Zero lower bound on nominal interest rates

Raising the inflation target could reduce the frequency and severity of ZLB episodes

A higher inflation target would raise the average level of nominal interest rates generally and the policy rate in particular, which would provide more room to cut rates before reaching the ZLB. This greater buffer would reduce the frequency of ZLB episodes. In addition, if inflation expectations are anchored on the target, a higher target allows a central bank to provide greater stimulus by making the real interest rate more negative.[4] This can attenuate the severity of ZLB episodes and reduce the likelihood of persistent deflation.[5]

Nevertheless, studies calibrated to match post-war data find that the ZLB is not a sufficiently important constraint on monetary policy to warrant raising the target. For example, Reifschneider and Williams (2000) find that assuming a 2.5 per cent real neutral rate and a 2 per cent inflation target, monetary policy would be constrained at the ZLB only about 5 per cent of the time, and ZLB episodes would typically last just one year. Fernández-Villaverde et al. (2012) obtain a similar result. Coibion, Gorodnichenko and Wieland (2012) compute the optimal rate of inflation in a model with the ZLB. They find that taking the ZLB into account raises the optimal rate of inflation from 0 to 1.5 per cent. Notably, their results suggest that the ZLB does not justify a target above 2 per cent.

However, the accumulation of evidence since the last renewal in November 2011 has reinforced the importance of the ZLB. Important factors include recognition that (i) in many countries, the ZLB has been a more persistent constraint than anticipated; (ii) unconventional monetary policy has been effective but has not fully compensated for the ZLB; (iii) shocks estimated using post-war pre-crisis data may underestimate the degree of volatility in the economy; and (iv) the neutral rate has declined, eroding some of the buffer against the ZLB. We review each of these considerations below.

A more persistent constraint on monetary policy than anticipated

In the immediate aftermath of the crisis, many expected the ZLB to be a short-lived constraint on monetary policy. For example, in November 2011, markets expected the Federal Reserve to

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[4] For example, with inflation expectations at 2 per cent, a zero nominal interest rate induces a real interest rate of -2 per cent. However, with inflation expectations at 3 per cent, the real interest rate can be lowered to -3 per cent.

[5] Deflation is often said to exert malignant effects by creating an incentive to delay purchases and by raising the real value of nominal debt. But these effects do not qualitatively distinguish deflation from low inflation. Indeed, for a given nominal interest rate, low expected inflation raises the real interest rate and causes households to delay consumption, and *ex post*, lower-than-expected inflation raises the real burden of nominal debt, depressing demand. Therefore, if deflation is special, it is perhaps because of its psychological significance. For example, a negative inflation rate might draw more attention than a low positive rate, possibly causing inflation expectations to become unanchored more quickly.

begin raising rates within a year. Three years later, the Congressional Budget Office estimated that the output gap remained close to 4 per cent, while the Fed was still constrained by the ZLB and expected to be for a "considerable time." More generally, the serial disappointment of recent years has elicited a greater appreciation for the potentially long-lasting nature of ZLB episodes. It has also led to the realization that even very low interest rates for a very long time may not provide sufficient stimulus in some situations. In this context, a higher inflation target could provide scope for additional stimulus by facilitating lower real rates.

Unconventional monetary policy has been effective but appears not to have fully compensated for the ZLB

Central banks have used both forward guidance and balance sheet policies such as quantitative easing at the ZLB. Two broad take-aways arise regarding the efficacy of unconventional tools: (i) they have been successful in helping restore the functioning of money markets and supporting economic activity (Kozicki, Santor and Suchanek 2011; Santor and Suchanek 2013); and (ii) considerable uncertainty remains regarding the quantitative effects of these policies. But, despite their apparent effectiveness, it appears that unconventional monetary policy (UMP) did not fully alleviate the constraint posed by the ZLB. This is suggested by the sizable output gaps that have persisted in economies constrained by the ZLB.

There are several possible explanations for why UMP may not have fully compensated for the ZLB. Some, such as former Fed Governor Jeremy Stein, argue that the marginal effectiveness of balance sheet policies may diminish with size. Others have expressed concerns about risks to central bank independence, possible adverse side effects on financial stability and complications associated with the withdrawal of unconventional measures. Finally, overly optimistic projections of the speed of the recovery by central banks that employed UMP may have caused them to provide less stimulus than was required. Overall, the extent to which UMP can be used to fully mitigate the effects of the ZLB remains an open question.

Post-war pre-crisis data may understate the degree of volatility in the economy

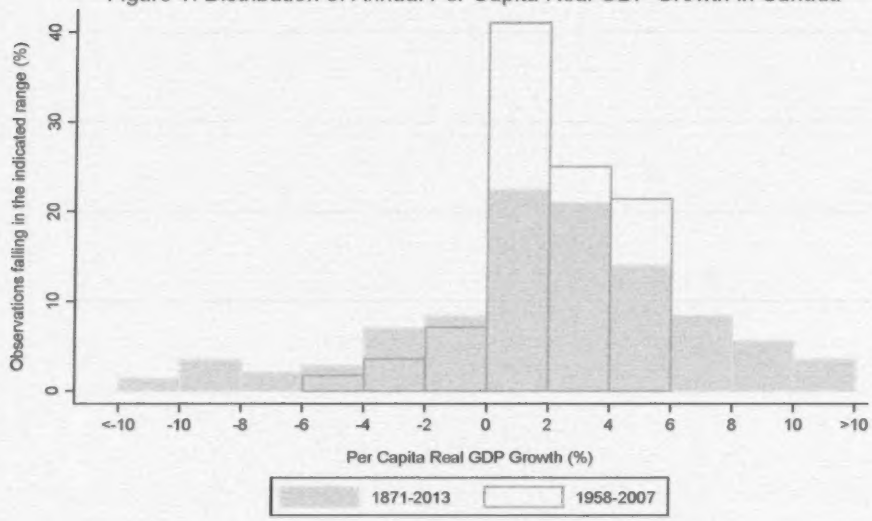
ZLB episodes are caused by shocks that drastically drive down aggregate demand and the outlook for output and inflation.[6] Such shocks are often amplified by existing vulnerabilities, such as financial imbalances. The shocks estimated from post-war pre-crisis time-series data are usually small and short-lived.

[6] Amano and Shukayev (2012) find that risk premium shocks are key to building quantitative models where the zero lower bound is relevant for monetary policy design. The risk premium mechanism operates by increasing the spread between the rates of return on private capital and risk-free government bonds. Other common shocks, such as aggregate productivity, investment-specific productivity, government spending and money demand shocks, are often unable to push nominal bond rates close to zero in model simulations.

The post-war pre-crisis data suggest that declines in GDP of the magnitude observed in the United States in 2009 (-3.7 per cent) are rare events. Likewise, the variability of Canadian GDP growth in the 50 years prior to the crisis suggests that declines of this magnitude would occur in about 0.4 per cent of all years, or roughly once every 250 years on average.[7] Focusing on this period likely contributed to the view that the ZLB was relatively unimportant.

But longer multi-country data sets developed by Barro and Ursúa (2010), Jorda, Schularick and Taylor (2011) and Schularick and Taylor (2012) reveal a different picture. Financial crises and sharp downturns in GDP are not as rare as the post-war pre-crisis data suggest. Figure 1 shows the distribution of annual GDP growth outcomes for Canada in the 50 years prior to the crisis (1958–2007) and for 1871–2013. More extreme outcomes were more frequent during the longer sample. Indeed, using the variability of GDP growth during the 1871–2013 period suggests that GDP declines at least as large as that observed in the United States in 2009 would occur in about 12 per cent of all years. Of course, advances in monetary policy and financial regulation together with changes in the structure of the economy probably mean that this longer sample overstates the volatility of output that can be expected in the future. Nevertheless, it illustrates how unusually stable the post-war period has been.

Figure 1: Distribution of Annual Per Capita Real GDP Growth in Canada



[7] Following Williams (2014), we assume that annual growth is normally distributed in order to calculate the probabilities. This is intended for illustrative purposes only.

A lower neutral rate

Globally, real interest rates have declined substantially in recent years. It is now widely accepted that this reflects, at least in part, lower neutral rates (PIMCO 2014; Dawsey 2014; Wilkins 2014). This has implications for the frequency of ZLB episodes. A lower neutral rate implies a lower average nominal rate of interest, which means there is less room to cut interest rates when needed.

The Bank's estimates for Canada suggest that the real neutral rate has fallen from around 3 per cent in the mid-2000s to about 1.5 per cent today (Mendes 2014). The previously cited studies that find monetary policy would be constrained by the ZLB about 5 per cent of the time are based on a real neutral rate of 2.5 per cent. Simulations in ToTEM (Terms-of-Trade Economic Model), the Bank's main projection and policy analysis model, using a real neutral rate of 3 per cent are consistent with this 5 per cent probability.[8] However, when the real neutral rate in ToTEM is reduced to 1.5 per cent, the probability of being constrained rises to about 15 per cent; that is, monetary policy would be constrained for 15 out of every 100 years. Thus, even taken in isolation, the lower neutral rate is sufficient to warrant revisiting the optimality of the 2 per cent target.

However, the analysis in ToTEM does not give any weight to pre-1995 data. Taking the volatility observed in earlier decades into account may raise the probability of being constrained by the ZLB. On the other hand, both the ToTEM simulations and the external studies cited earlier exclude any role for unconventional monetary policy. Allowing for unconventional policy could mitigate the adverse impact of being at the ZLB. In addition, a more comprehensive analysis would need to account for the impact of financial regulatory reform on the likelihood of financial crises.[9]

3. Costs of Higher Inflation

While the above considerations suggest that there might be benefits to raising the inflation target, higher inflation would also entail costly distortions. Previous research identified several channels through which inflation may cause such distortions (Bank of Canada 2011). In this section, we review a selection of the key findings in this literature, ignoring the ZLB. The implications for the optimal rate of inflation are summarized in Table 1. The main conclusion is that, in the absence of the zero lower bound, the optimal rate of inflation is zero or negative.

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[8] More details on ToTEM can be found in Dorich et al. (2013).

[9] The CPI measurement bias also has implications for the optimal rate of inflation. Reductions in the bias, by effectively raising the true rate of inflation, would mitigate the need for an increase in the target. Quantitatively, this effect is likely to be small.

Table 1: Implications of alternative classes of models for the optimal rate of inflation

Class	Implied optimal rate of inflation
Sticky prices and relative price dispersion	Zero
Sticky wages and productivity growth	Deflation (at the rate of productivity growth)
Money demand and asset allocation	Deflation (at the real rate of interest)
Non-indexed pensions	Zero or negative
Tax distortions	Zero

Sticky prices and relative price dispersion

Evidence shows that prices fail to adjust promptly and uniformly to changing market conditions. Such nominal rigidities can potentially lead to *relative* price dispersion. For example, with positive inflation, prices that remain unchanged become lower relative to prices that adjust in every period.

Such dispersion in prices makes households shift their consumption across goods. This shift is distortionary since households prefer a balanced consumption basket (Woodford 2003). The corresponding differences in production lead to a misallocation of factor inputs across sectors (Coibion, Gorodnichenko and Wieland 2012). In this class of models, the main goal for policy-makers is to minimize price dispersion by setting the rate of inflation near zero.

There is an important caveat, however. Recent studies that take firm-level idiosyncratic shocks into account find that resource misallocation need not increase greatly with inflation. In essence, a higher inflation target causes firms to adjust their prices more promptly in response to firm-level shocks, thereby mitigating misallocation of production inputs.[10]

Sticky wages and productivity growth

Amano et al. (2009) study optimal inflation in a model with exogenous growth and staggered adjustment of nominal wages. Their results suggest that *negative* inflation is optimal. Deflation partially compensates for nominal wage rigidity by allowing the real wage to rise as labour productivity improves, without the need for nominal wage adjustment. The authors find that this sticky-wage effect has stronger welfare implications than price dispersion. Plausible parameterizations imply that deflation near the rate of productivity growth is optimal.[11]

Money demand and asset allocation

As Friedman (1969) observed, the opportunity cost of holding cash is equal to the nominal interest rate, while the social cost of creating money is virtually zero. If the opportunity cost

[10] Blanco (2015) shows that accounting for these effects in a model with the ZLB raises the optimal inflation target to 5 per cent.

[11] Amano et al. (2009) assume symmetric upward and downward nominal wage rigidity. If wages are relatively more downwardly sticky, then the negative optimal inflation rate may be closer to zero.

exceeds the social cost—as will normally be the case with a positive nominal interest rate—the allocation of asset holdings will be distorted. In essence, people will hold too little money. This is the rationale for the well-known Friedman rule: deflate at a rate equal to the negative of the real interest rate in order to drive the nominal interest rate to zero. Furthermore, since higher inflation tends to be associated with higher inflation volatility, it increases the spreads of real asset returns, discourages investment and shifts wealth from creditors to debtors (Meh and Terajima 2011). Going forward, the cost of higher inflation for asset allocation may be exacerbated by the aging population, since retirees have higher average wealth holdings.

Non-indexed pensions

Positive inflation erodes the real value of any source of fixed nominal income, including non-indexed pensions. Maintaining a constant real value of non-indexed pensions would call for a zero inflation target. However, since real wages can be expected to increase over time, zero inflation would still cause the incomes of those receiving non-indexed pensions to decline relative to the incomes of the working-age population (Whitehouse 2009). While further study is needed to establish the extent to which this effect reduces aggregate welfare, it is clear that avoiding this relative decline would require a negative inflation target.

Tax distortions

Finally, inflation can exacerbate tax distortions (Black, Macklem and Poloz 1994; Feldstein 1997). For example, the fact that nominal, rather than real, interest income is taxed means that investors must pay tax on compensation for inflation in addition to real returns. This can cause investors to demand additional compensation in the form of higher pre-tax real returns, which may discourage firms from borrowing to finance physical investment. Black, Macklem and Poloz (1994) analyze the costs of inflation in a model that attempts to capture a broader set of tax distortions, including personal income taxes, sales taxes, corporate profit taxes, investment tax credits, and deductions for inventory and depreciation expenses. They find that tax distortions cause positive inflation to have relatively large costs.

4. Outstanding Issues

In order to assess the costs and benefits associated with a higher inflation target, several outstanding issues will have to be addressed. This section provides a (non-exhaustive) discussion of some key issues.

Unconventional monetary policy

Much of the existing work on the costs associated with the ZLB ignores the possibility of using UMP. Future research will need to examine the possibility of using at least three types of UMP: (i) balance sheet policies such as quantitative easing, (ii) forward guidance and (iii) negative nominal interest rates.

In order to consider balance sheet policies in the most realistic manner, it will be important to gain a more complete understanding of why, in practice, unconventional policies have not fully offset the undesirable effects of the ZLB, as suggested by some evidence (Williams 2014). In particular, to what extent do side effects or diminishing returns associated with balance sheet policies reduce their value as substitutes for conventional policy?

On forward guidance, Mendes and Murchison (2014) have found that history-dependent policies, such as temporary price-level thresholds, can be an effective tool at the ZLB. However, before using such tools, additional work is needed to evaluate the risks. In 2011, the Bank concluded that the expected benefits of a *permanent* shift to price-level targeting did not justify the risks stemming from uncertainty about the nature of expectations formation. But the balance of risks and benefits may differ if price-level targeting is considered merely as a temporary measure to escape the ZLB (i.e., as part of threshold-based forward guidance). Future work should evaluate the potential costs associated with such history-dependent forward guidance in the event that it is poorly understood by the public.

Throughout this paper we have made the conventional assumption that nominal interest rates cannot fall below zero. Recently, however, a number of central banks have introduced negative policy interest rates. It will be important to review the international experience with negative nominal interest rates.

Downward nominal wage rigidity

More than a decade of data have accumulated since Crawford and Wright (2001) reached their conclusions regarding the economic significance of DNWR in Canada. As such, it may be an opportune time to review this issue with more recent data.

Taxation of nominal interest income

As discussed earlier, taxation of nominal (rather than real) interest income makes higher inflation costly. However, it can also enhance the benefits associated with higher inflation. When nominal interest income is taxed, the nominal interest rate will tend to increase more than one-for-one with expected inflation (because investors will demand additional compensation to ensure an unchanged real after-tax rate of return).[12] Since a higher nominal interest rate means a greater buffer against the ZLB, the tax system effectively enhances the

[12] With taxation of nominal interest income, the Fisher equation must hold in terms of the after-tax nominal return. If τ is the tax rate, i is the nominal interest rate, r is the required real interest rate and π is the expected inflation rate, then the approximate Fisher equation is

$$(1-\tau)i = r + \pi.$$

This implies that a 1 percentage point increase in π will increase i by $1/(1-\tau)$ percentage points. For example, if $\tau = 1/3$, then a 1 percentage point increase in π will increase i by 1.5 percentage points.

buffer value of higher inflation. An assessment of the importance of this effect may be worthwhile.

Measurement bias in the CPI

The CPI is subject to several types of measurement bias that cause measured inflation to overstate true inflation. Sabourin (2012) estimates that the measurement bias is around 0.5 per cent in Canada. However, recent improvements to the measurement of the CPI implemented by Statistics Canada may have caused the bias to decrease. In this context, an updated assessment of the size of the CPI measurement bias may be warranted.

Hysteresis

Labour market hysteresis may increase the cost of prolonged downturns associated with the ZLB and hence may influence the optimal rate of inflation. Research on the relationship between hysteresis and the level of the inflation target could help to clarify the importance of this consideration.

Costs of Inflation

While there is a broad literature on the costs of inflation (selectively reviewed in the previous section), there may still be scope for updating some of this analysis. In particular, it may be worthwhile to review the costs of higher inflation induced by (i) transitional redistributions of wealth, (ii) tax distortions, (iii) non-indexed incomes, and (iv) wage and price stickiness.

5. Concluding Remarks

This paper has provided a selective overview of the current state of knowledge and key outstanding issues regarding the costs and benefits of a higher inflation target to complement prior analysis examining issues associated with a lower inflation target. The principal anticipated benefit associated with a higher inflation target would be a reduction in the frequency and severity of zero lower bound (ZLB) episodes. Earlier analysis concluded that the ZLB did not warrant an inflation target above 2 per cent. However, several recent developments suggest that this conclusion should be revisited. These include recognition that (i) the ZLB has been a more persistent constraint than anticipated; (ii) unconventional monetary policy has been effective but appears not to have fully compensated for the ZLB; (iii) shocks estimated using post-war pre-crisis data may underestimate the degree of volatility in the economy; and (iv) the neutral rate has declined, eroding some of the buffer against the ZLB.

Together, these factors suggest that consideration should be given to a target above 2 per cent. However, as Côté (2014) points out, there is good reason to be cautious. The 2 per cent target gradually gained credibility as it came to be regarded as a stable and achievable objective. This accrued credibility makes monetary policy more effective and flexible as a stabilization tool.

Hence, when contemplating changes to the target, it is important to carefully account for both the transitional and long-run costs associated with higher inflation. Moreover, careful analysis will be needed to evaluate the extent to which unconventional policy tools mitigate the effects of the ZLB and hence reduce the need for a higher target.

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